ODYSSEE-MURE

Enerdata intelligence + consulting

Energy efficiency trends in the EU: Have we got off track?

Odyssee-Mure webinar series on Energy Efficiency
organised by Leonardo ENERGY

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About ODYSSEE-MURE

- This webinar is organized in the framework of the ODYSSEE MURE Project.

- This project is supported by the H2020 programme of the European Commission. It covers 31 countries*, mainly energy efficiency agencies or Ministries; it is coordinated by ADEME, with the support of Enerdata and Fraunhofer-ISI.

- Its main objectives are to:
  - ✓ Evaluate and compare energy efficiency progress by sector, in relation to the observed trend in energy consumption and to the EU targets ;
  - ✓ Evaluate energy efficiency policy measures and identify the "best measures" .

- The project relies on two data bases:
  - ✓ **ODYSSEE** on energy efficiency indicators;
  - ✓ **MURE** on all policy measures implemented by sector, and their impact evaluation.

www.odyssee-mure.eu

**28 EU Member States (UK included)+ Norway, Serbia and Switzerland*

ODYSSEE-MURE The ODYSSEE data tools

The webinar is based on data and indicators prepared in the framework of the ODYSSEE-MURE project, and disseminated in a data base and 5 data tools

www.indicators.odyssee-mure.eu

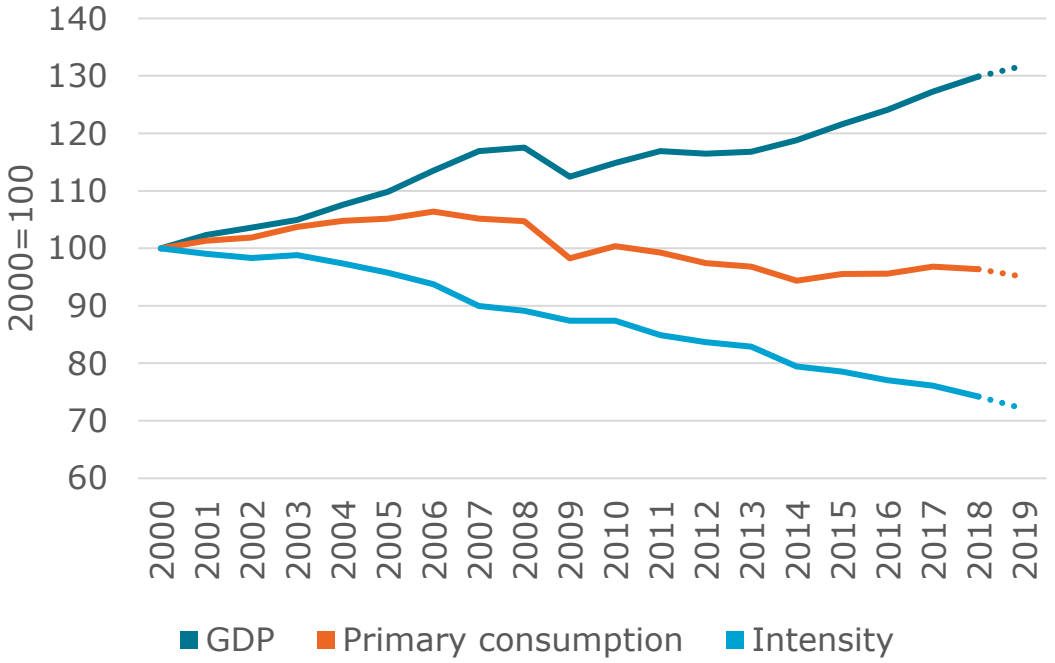
The data and indicators are updated to 2019 using final energy consumption data produced by Enerdata and "early estimates" of key indicators produced by ODYSSEE through a new methodology (to be revised later and included in data tools in October).

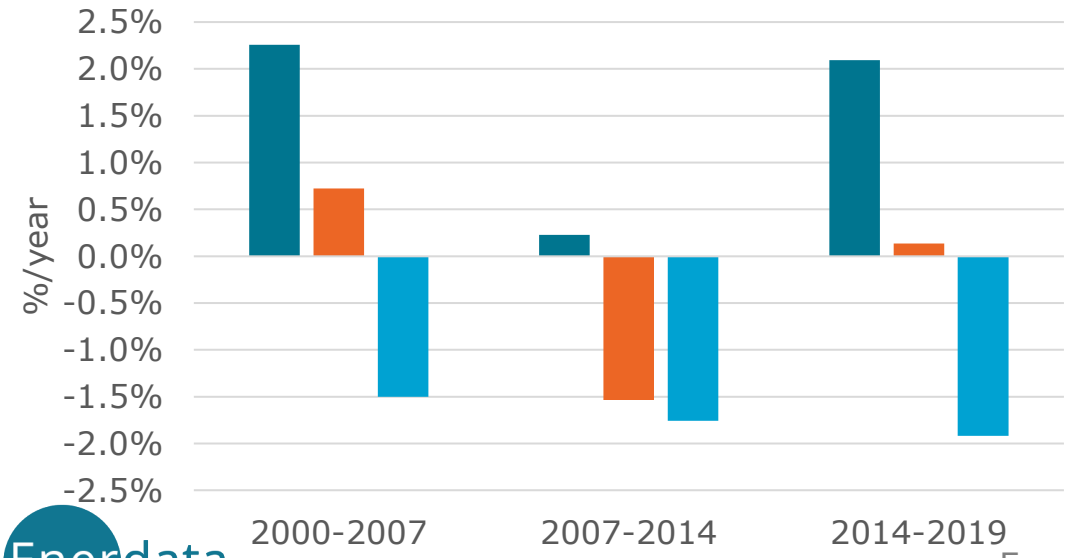
Outline

- Energy consumption trends
- Energy efficiency trends
- Conclusions : have we got off track?

Energy consumption trends

Primary energy consumption and intensity VS GDP



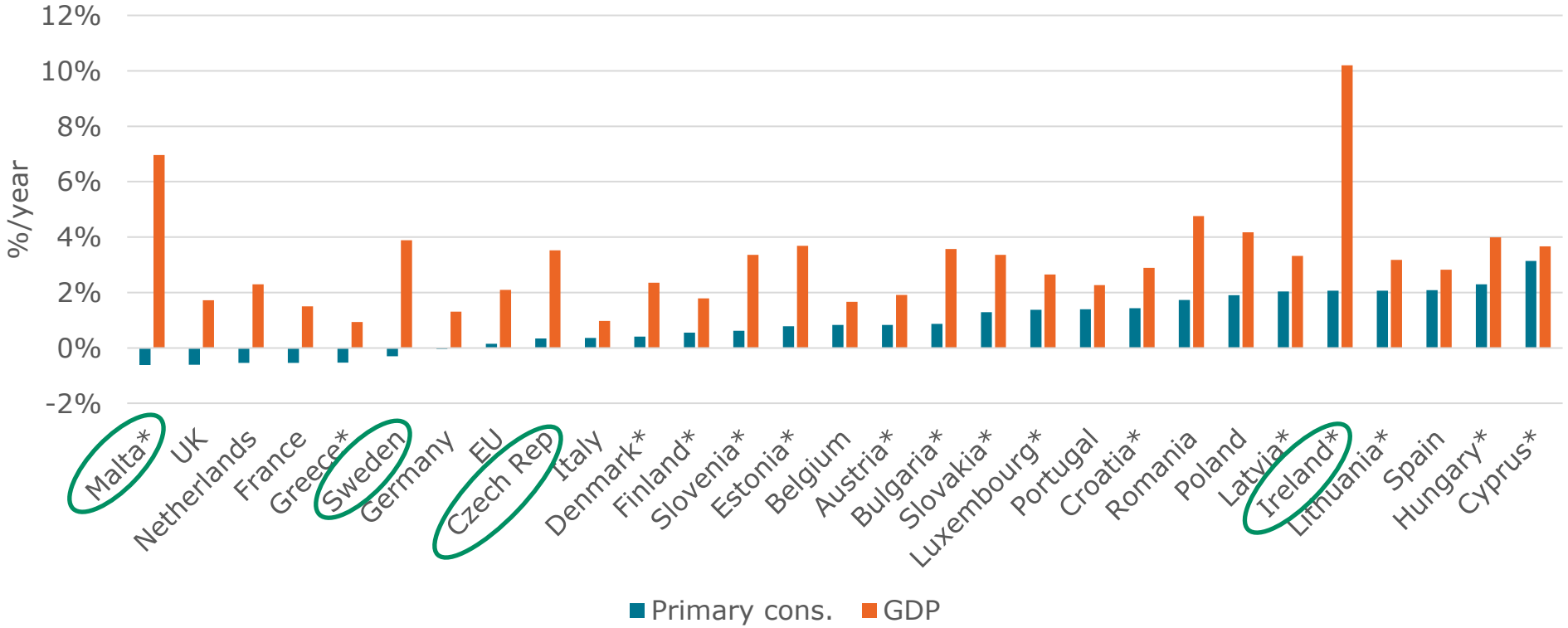


- Stability of the EU primary consumption (total energy supply) since 2014, although the GDP increased by 2%/yr with the return to economic growth.
- This follows a significant decrease of 1.5%/yr between 2007 and 2014 due to the financial crisis of 2009.
- Regular and rapid decrease of the primary energy intensity since 2007 (~1.8%/year), slightly faster than over 2000-2007 (+0.3 pt)

Consumption and intensity at normal climate, Source: ODYSSEE

Primary consumption and GDP trends over 2014-2019

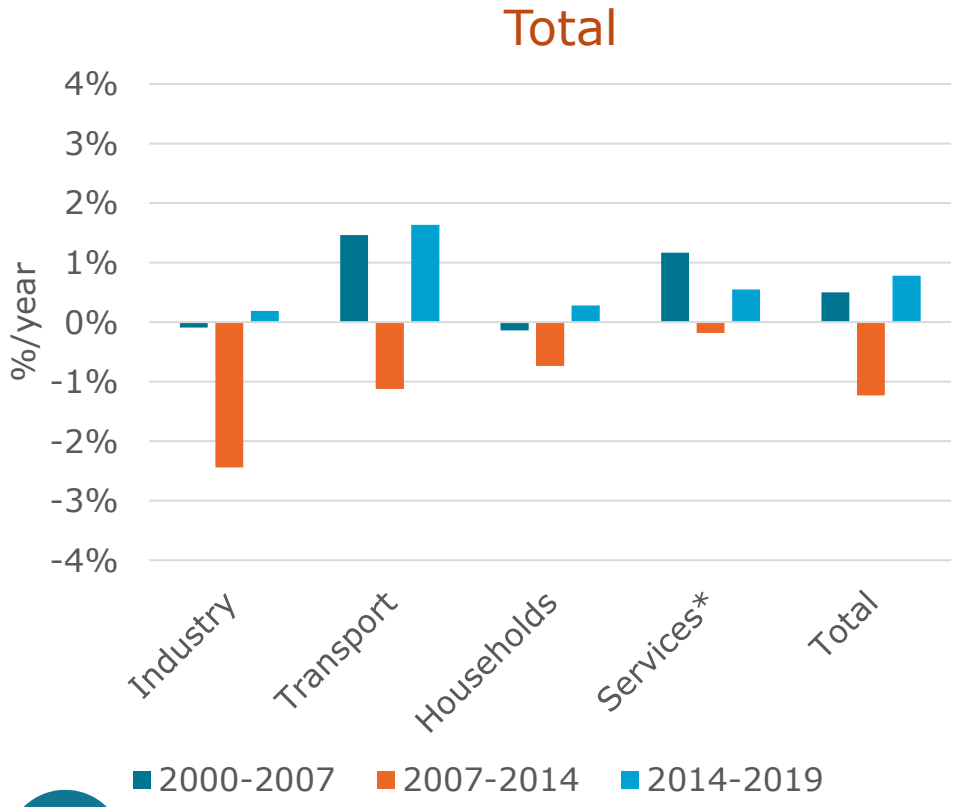
- Since 2014, decreasing primary consumption in 7 countries and low consumption growth below the 0.5%/year observed for the EU in 3 other countries.
- Everywhere the consumption is progressing much slower than the GDP, implying a decreasing energy intensity, especially significant in Ireland, Malta, Sweden and the Czech Rep (below 3%/yr).

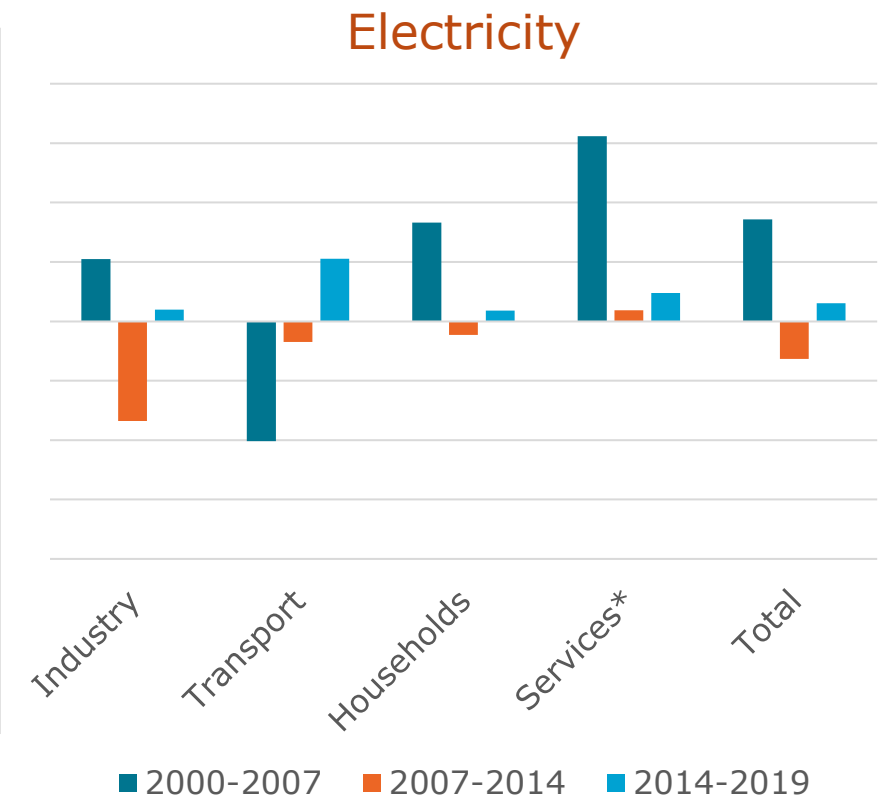


Consumption at normal climate; *Sources: ODYSSEE until 2017, Enerdata for 2018 and 2019; *2014-2018.*

Final energy consumption trends

- Final consumption, i.e. consumption in industry, transport and buildings, grows again since 2014 with the economic rebound: 0.8%/year.
- This contrasts greatly with the primary energy consumption trend.
- Electricity grows much slower (0.3%/yr), as opposed to past trends.
- Transport is the most dynamic sector since 2014 (1.6%/yr, similar to 2000-2007 trend), while industry has the lowest progression (0.2%/yr).



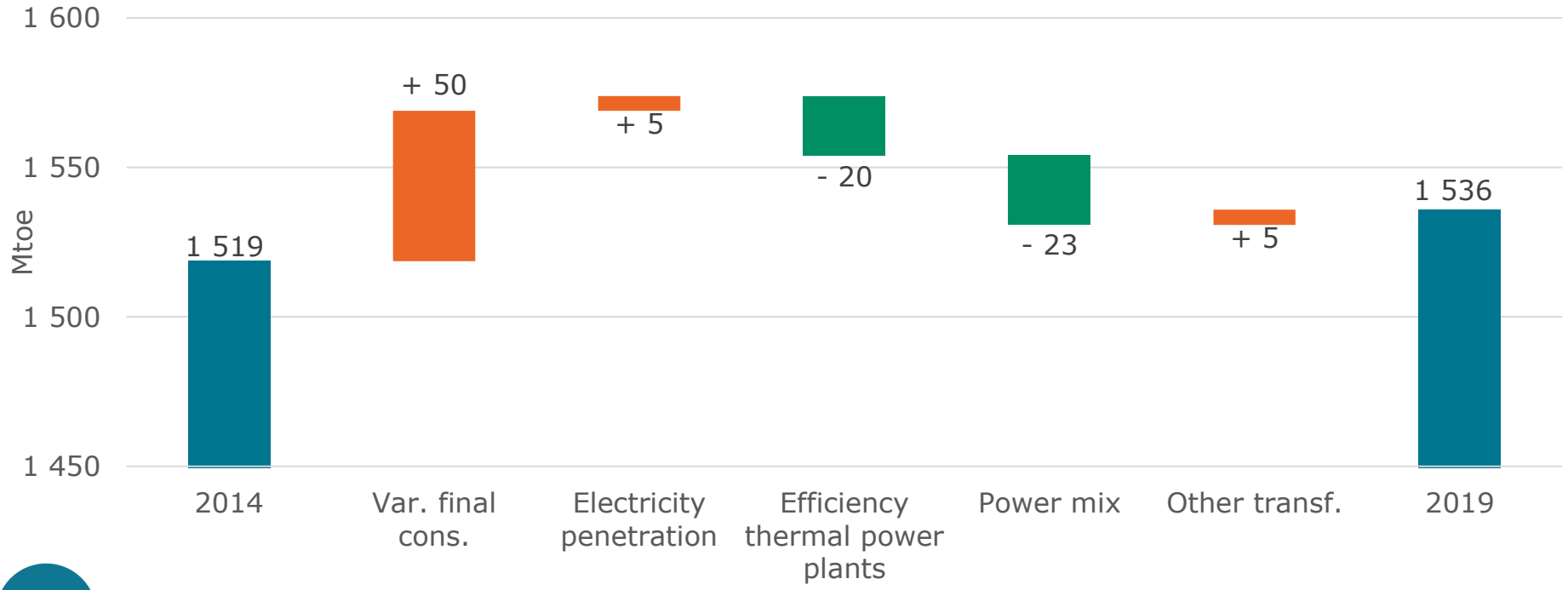


Households and services at normal climate
*Services include non-specified
Source: ODYSSEE

A higher progression of final energy consumption

- Between 2014 and 2019, the primary consumption increased by 17 Mtoe, compared to 50 Mtoe for the final consumption.
- This much lower progression of the primary consumption is due to:
  - a significant change in the power mix (higher share of renewables, lower share of nuclear) which contributed to lower the increase in primary consumption by 23 Mtoe
  - the increasing efficiency of thermal power plants (-20 Mtoe)

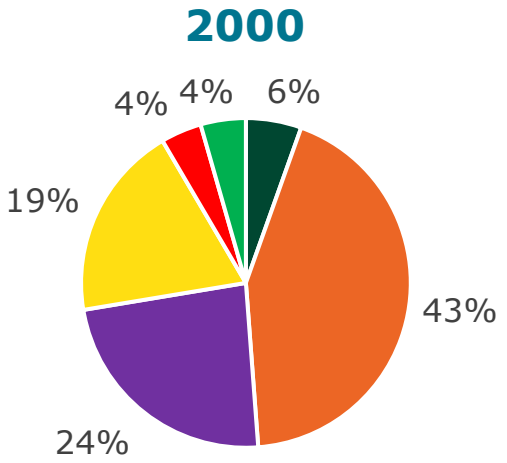
Drivers of primary energy consumption variation over 2014-2019

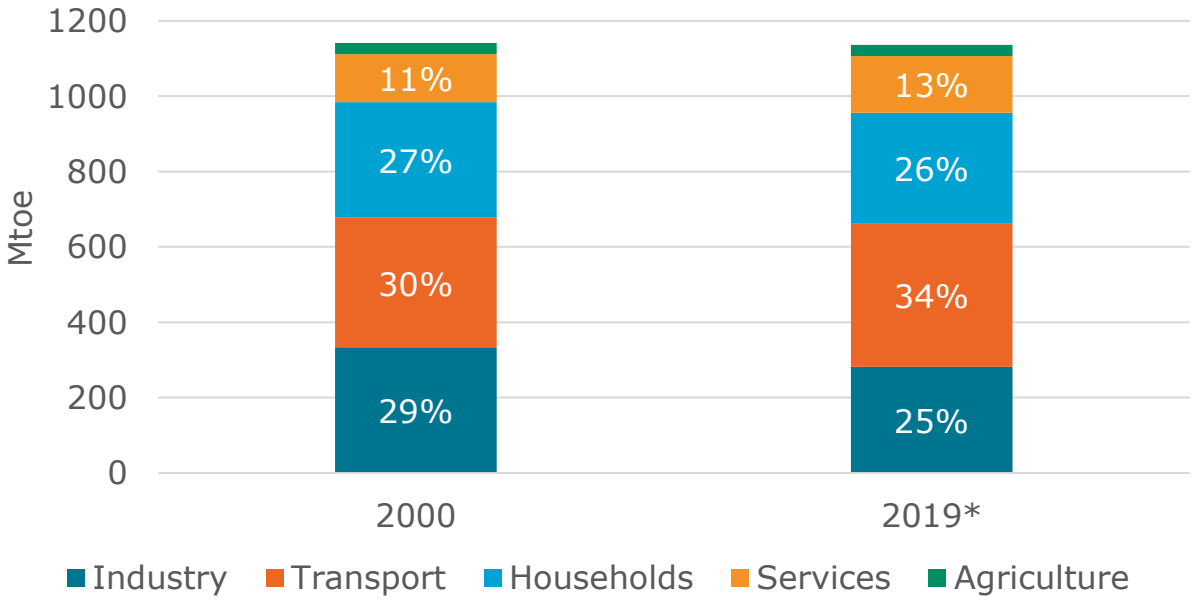


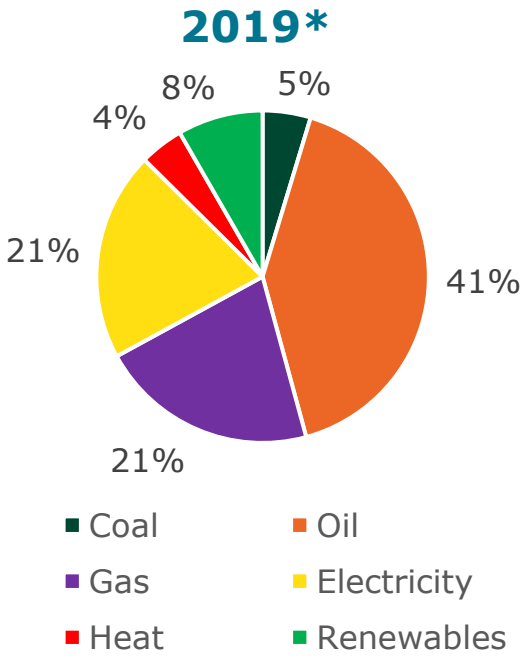
Source: ODYSSEE Decomposition tool

Final energy consumption by sector and by energy

- Increasing share of transport in total final consumption from 30% to 34% in 2019 while industry' share decreased by 4 pts, down to 25%.
- Doubling of the direct penetration of renewables (from 4 to 8% in 2019).
- Decreasing share for gas (from 24% in 2000 to 21% in 2019) and for oil (from 43% to 41%) while electricity share increased by 2 points.







At normal climate for households and services
Sources: 2000: ODYSSEE and 2019 : Enerdata

Energy efficiency trends

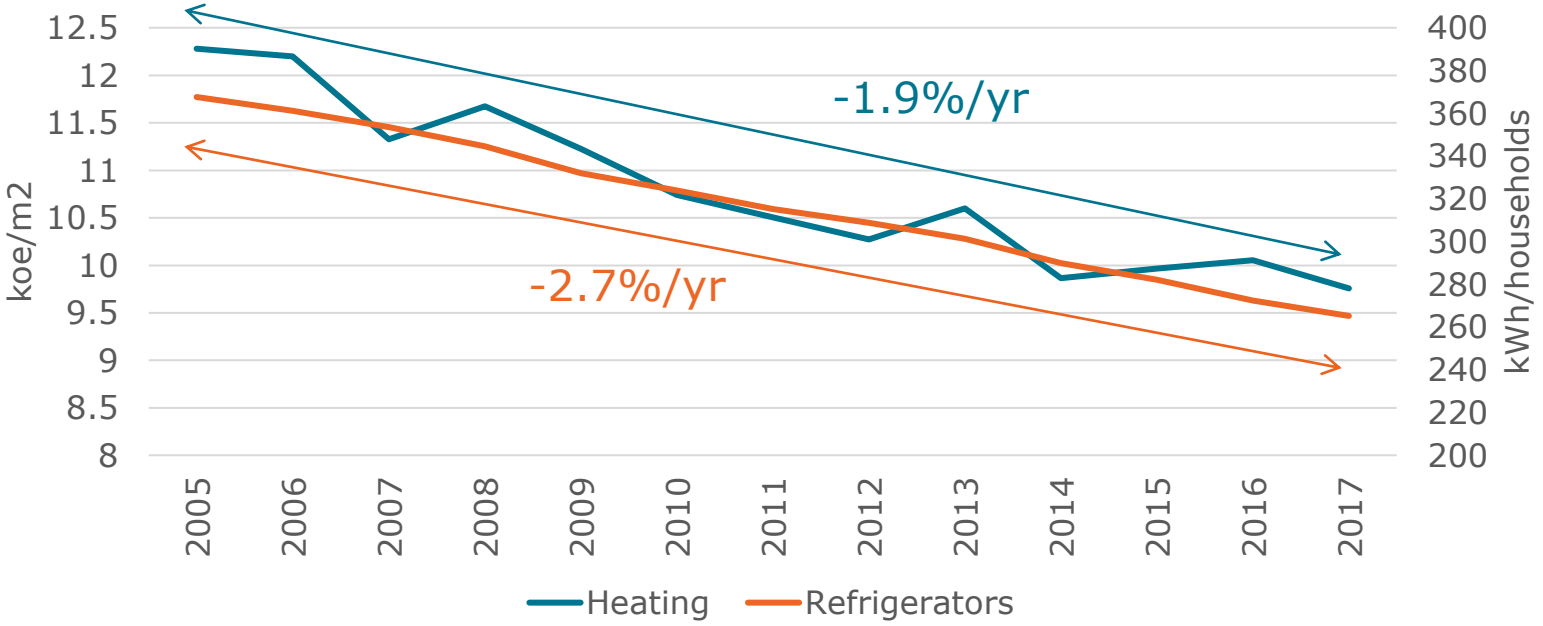
How is measured energy efficiency progress in ODYSSEE?

- At the level of sub-sectors or end-uses, energy efficiency progress is assessed through a wide variety of indicators of specific consumption, measured in physical units, such as:
  - ✓ toe/ton for steel, cement in industry (or GJ/t);
  - ✓ toe/pkm for cars, toe/tkm for freight in transport;
  - ✓ toe/m2 for heating, kWh/household for electrical appliances and AC, … for households ;
  - ✓ kWh/employee, per m2, per bed … in services.
- Examples of sectoral indicators are provided in the ODYSSEE "key indicators tool"*

* https://www.indicators.odyssee-mure.eu/online-indicators.html

The question now is how to measure energy efficiency progress at sector level?

- For households, we may obtain for instance different energy efficiency trends: 2.7%/yr for refrigerators and 1.9%/yr for heating.



- The question now is how can we combine the different assessments of energy efficiency progress by end-use to get one trend for the whole sector?
- This is the objective of the energy efficiency index, called "**ODEX**".

How is calculated ODEX?

- ODEX is calculated:
  - First, by expressing trends in specific energy consumption by end-use or sub-sector, as an index of variation ;
  - Then by calculating a average index for the sector weighted by the share of each end-use or sub-sector in the sector's energy consumption.

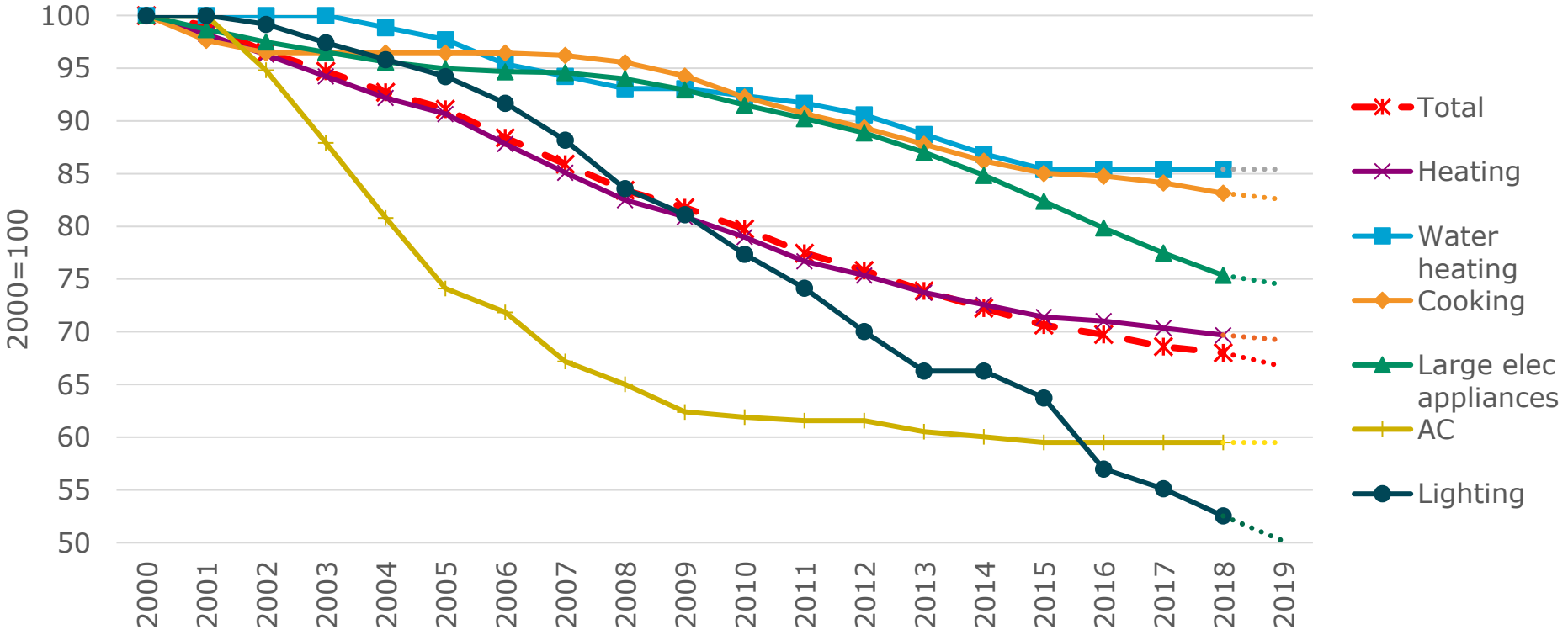
- As for each sub-sector, index of variation are used, specific consumption can be expressed in different physical units so as to be as close as possible to energy efficiency evaluation.

- ODEX is presently calculated on the basis of up to 40 sub-sectors (8 modes in transport, 11 end-uses for households, 14 branches in industry, 6 branches in services).

For more information on ODEX: https://www.indicators.odyssee-mure.eu/odex-indicators-database-definition.pdf

Example of ODEX: households in the EU

- ODEX equal 67 in 2019 ➔ households energy efficiency has improved by 33% at EU level between 2000 and 2019 (or 2.1%/year).

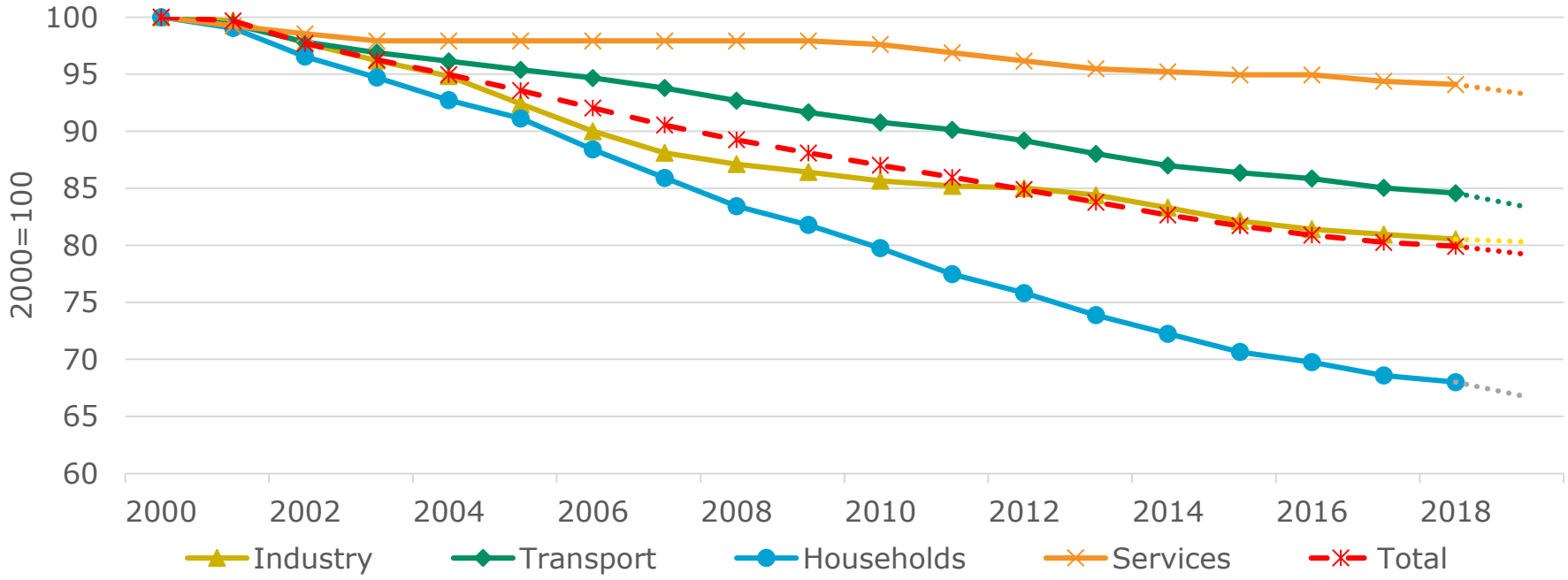


Only main end-uses shown; ODEX calculated on the basis of 11 end-uses/large appliances : heating (toe/m2) (separation new/existing dwellings), water heating, cooking (toe/dwelling), cooling, lighting, refrigerator, freezer, washing machine, dishwasher, dryer, TV (kWh/appliance)

Source: ODYSSEE

Energy efficiency index (ODEX) for final consumers

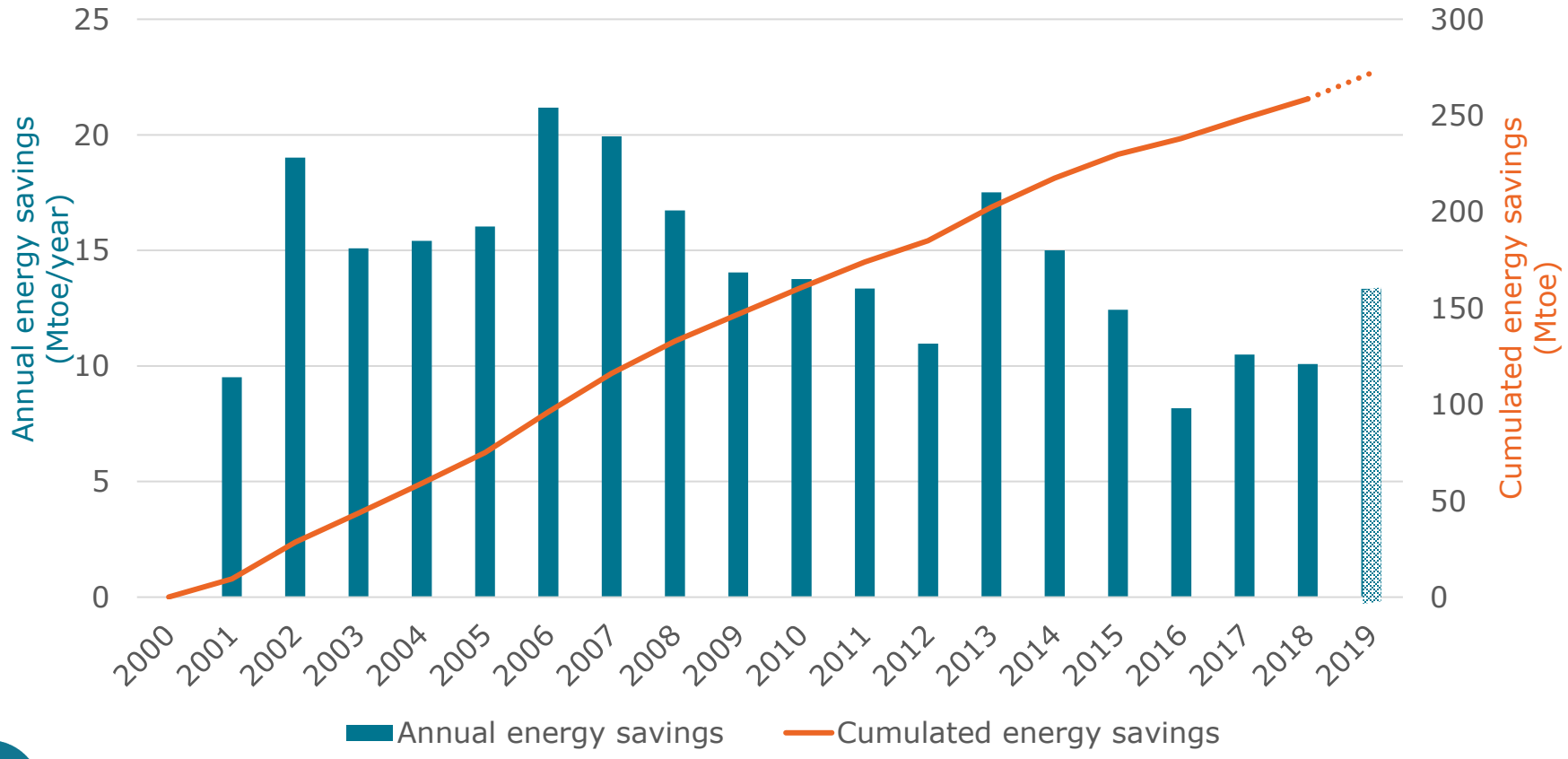
- Energy efficiency of final consumers improved by 1.2%/yr from 2000 to 2019, with a slow down in recent years (0.9%/yr since 2014).
- Larger gains for households (2.1%/yr since 2000), with a net slow down since 2014 (1.6 %/yr).
- Rate of improvement divided by more than 2 in industry, since 2007 (0.8%/yr compared to 1.8%/yr before).
- Regular but limited improvement in transport (1%/year).



ODEX=79 in 2019 ➔ 21% energy efficiency improvement or 1.2%/yr
Source: ODYSSEE

Energy efficiency progress results in energy savings

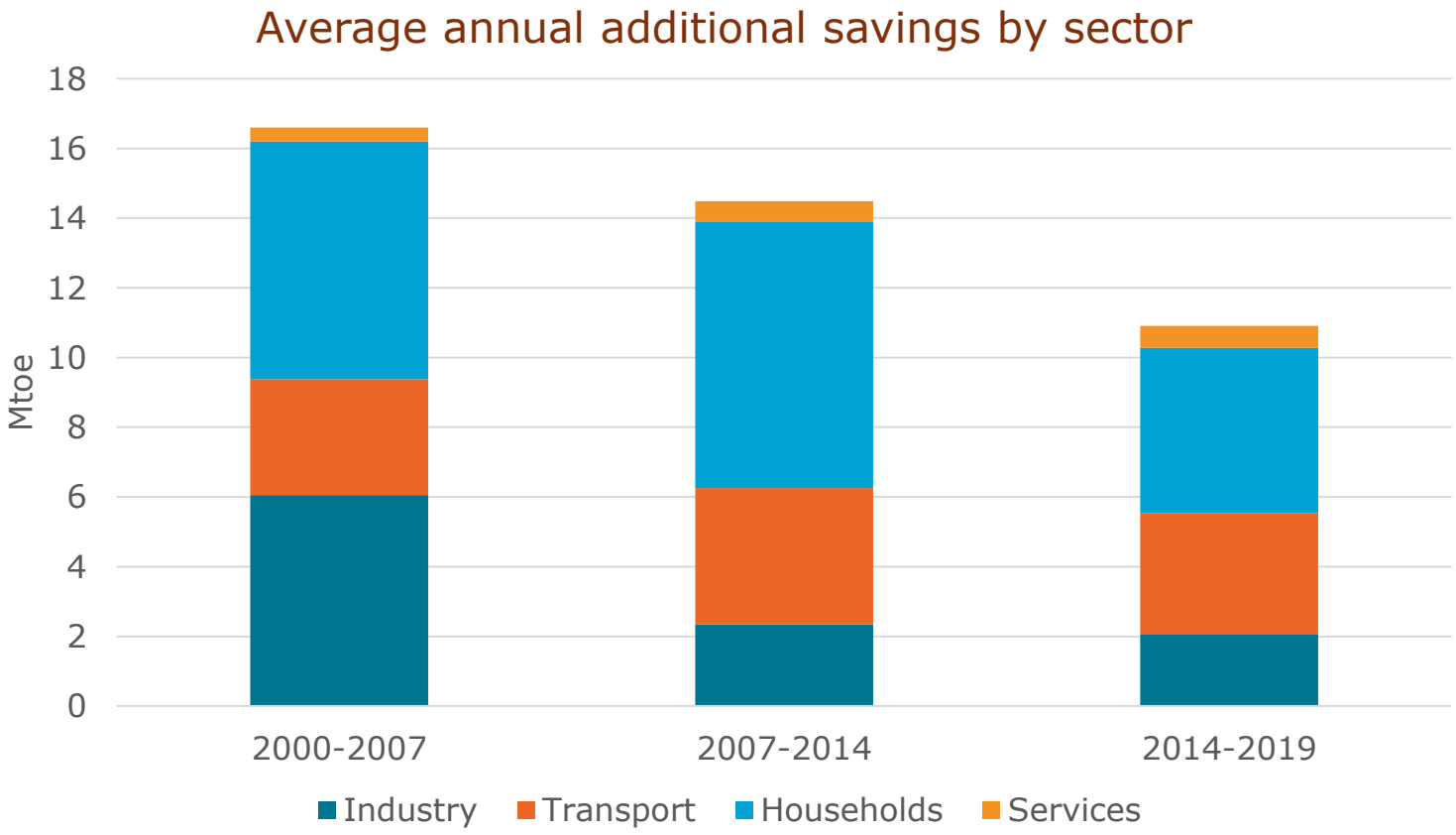
- Energy efficiency progress has saved every year since 2000, an additional volume of 14 Mtoe.
- These annual savings are fluctuating but tend to decrease over time.
- Cumulated since 2000, these savings reached around 270 Mtoe in 2019.



Source: *ODYSSEE*

Regular decrease in energy savings

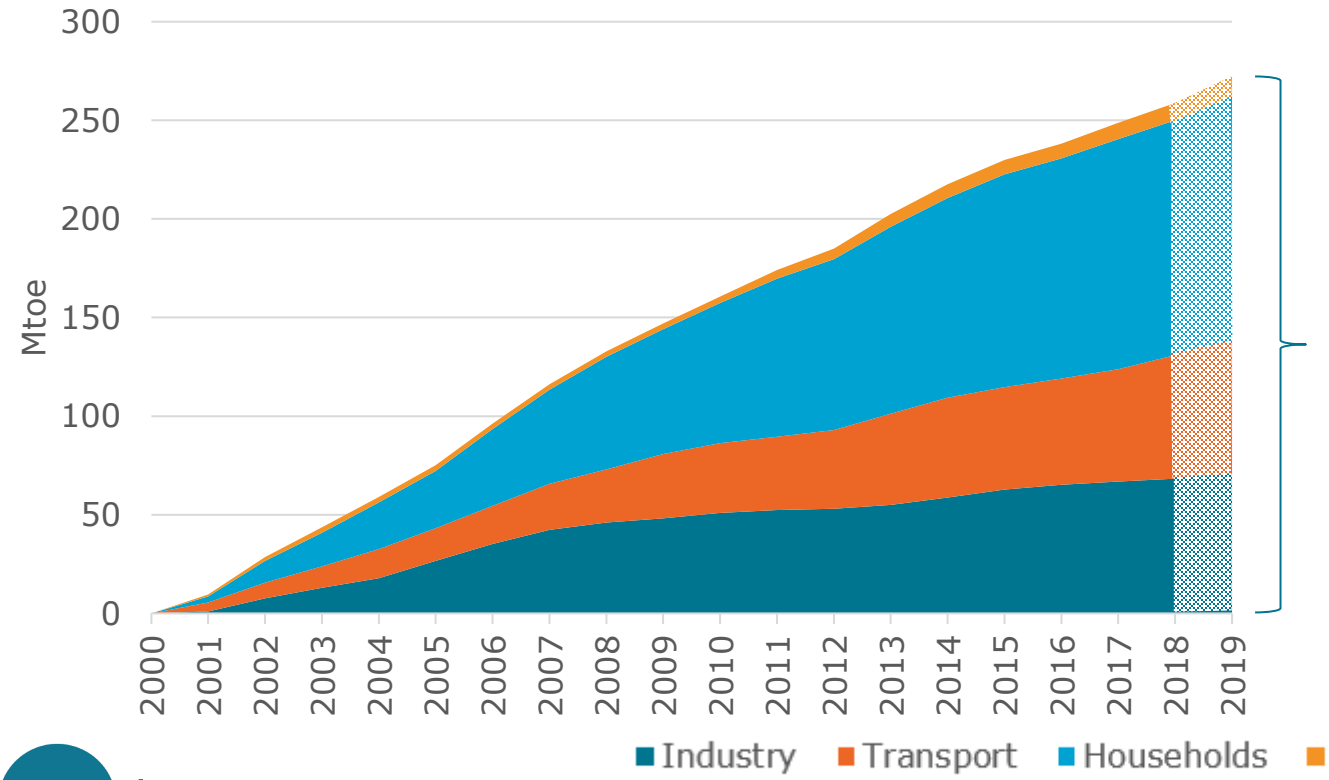
- Because of the slowing pace of energy efficiency improvement, the annual additional savings have been regularly decreasing: from an average volume of 16.5 Mtoe/yr over 2000-2007 to 14.5 Mtoe/yr over 2007-2014 (divided by 3 in industry) and 11 Mtoe/yr since 2014 (1/3 reduction for households).



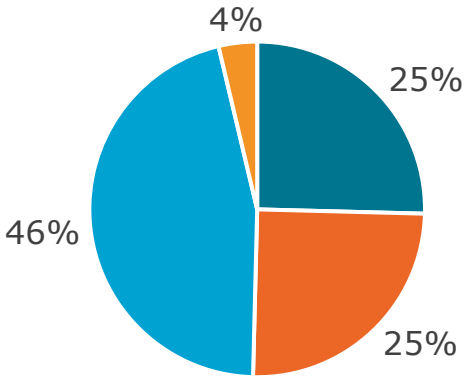
Source: *ODYSSEE*

Energy savings versus consumption

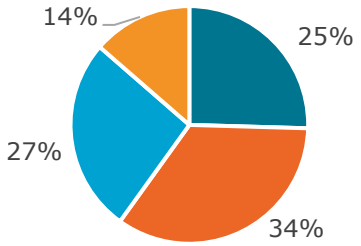
- The cumulated energy savings in 2019 since 2000 represents the equivalent of 25% of final energy consumption: in other words without these savings the final consumption would have been 25% higher.
- Households, the sector with the highest number of regulations, is over represented, with a share of total savings (46%), much higher than its share in consumption (27%). On the other hand, savings in transport are much lower than their share in consumption (25% vs 34%).



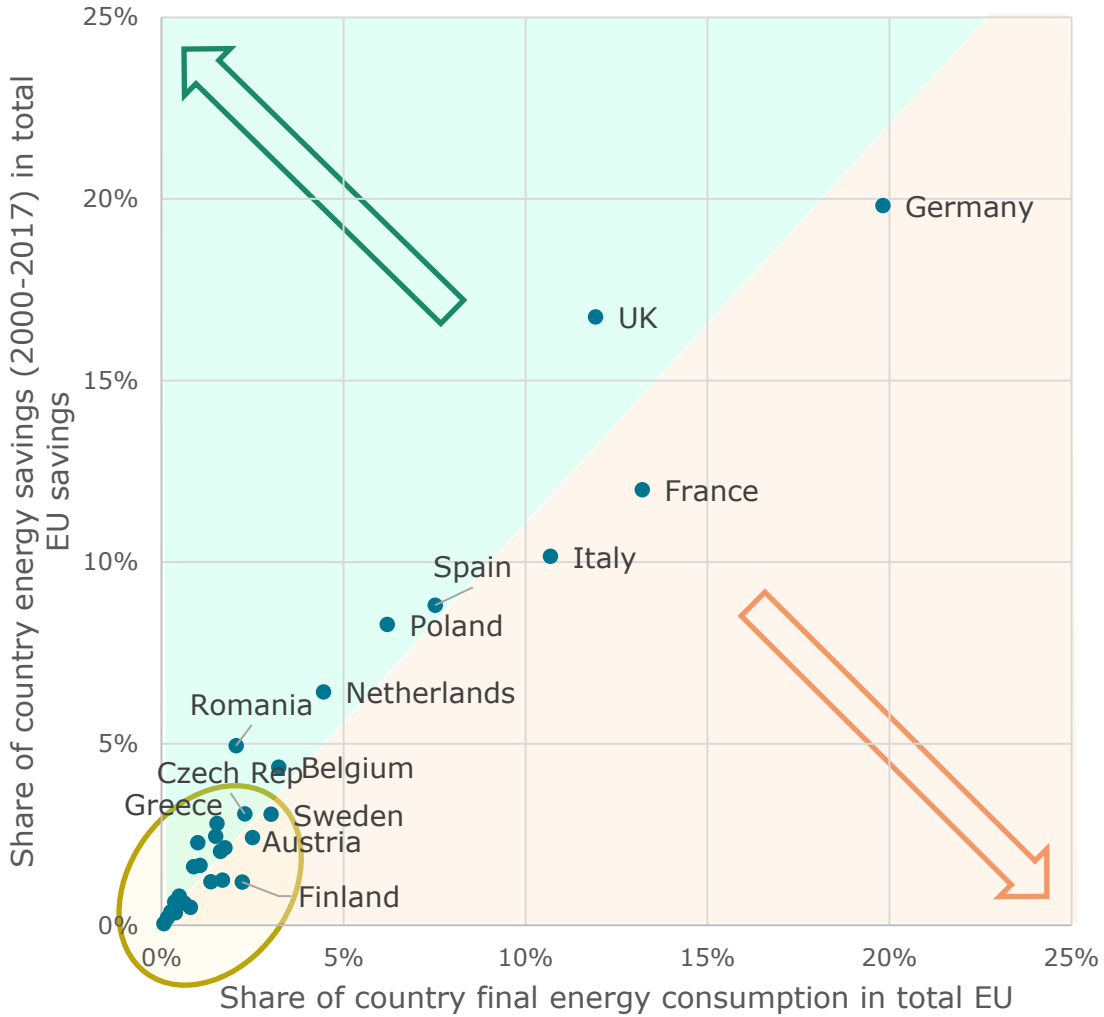
% in energy savings



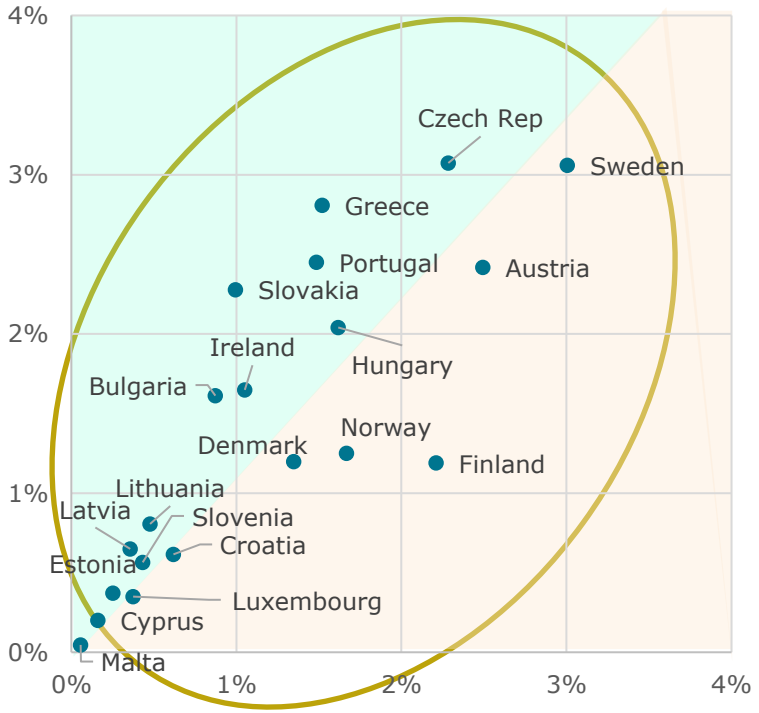
% in final consumption



Source: ODYSSEE



- Long-standing EU Member States (e.g. Germany, Italy and France) have a relatively lower share of energy savings since 2000, as they had a greater effort before.
- New EU MS (e.g. Slovakia, Bulgaria or Latvia) have a higher share due to greater efforts in terms of energy savings since 2000



High share of energy savings in final consumption (>25%)

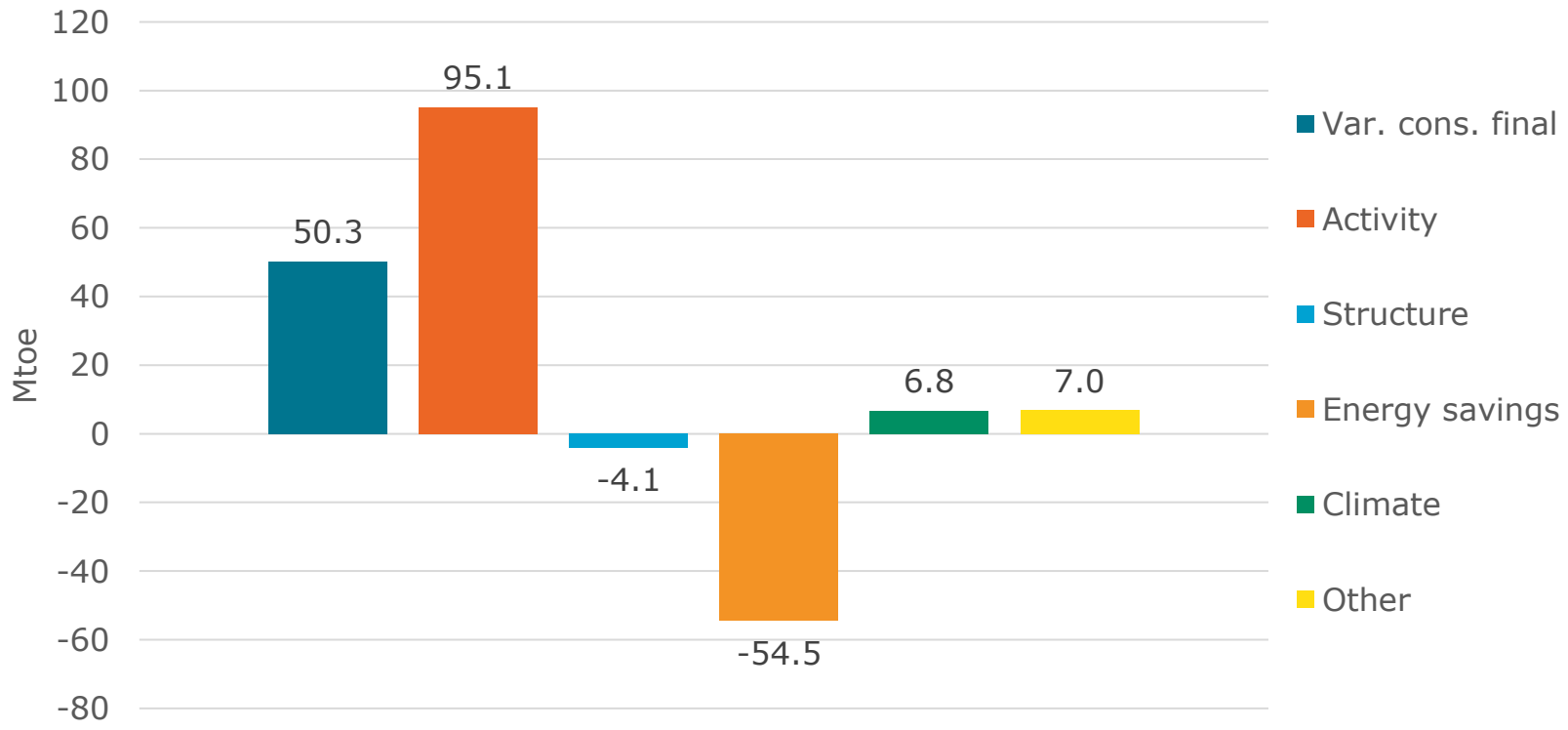
Low share of energy savings in final consumption (<25%)

Enerdata

Source: ODYSSEE

Drivers of final energy consumption variation: 2014-2019

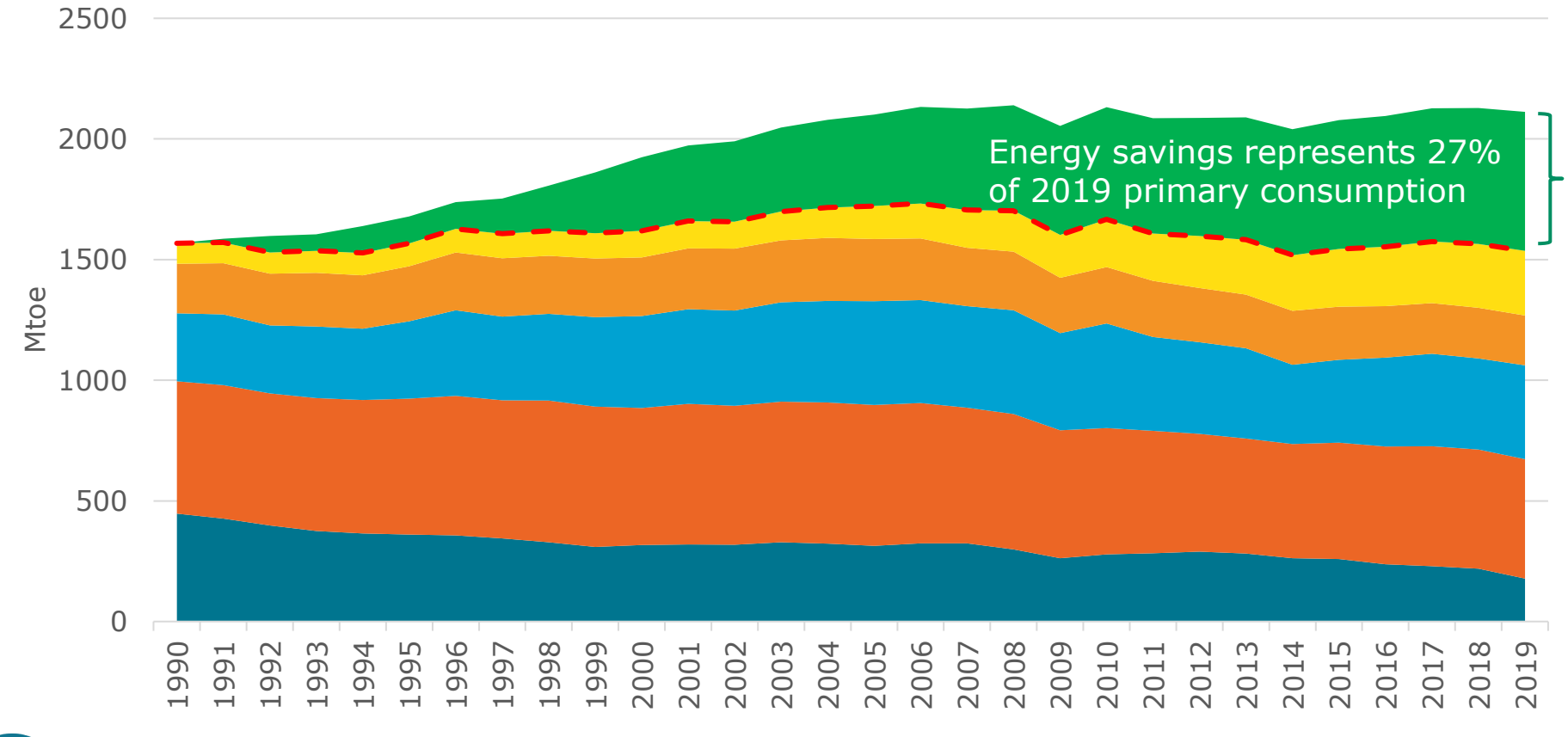
- Between 2014 and 2019, the economic and demographic growth ("activity") contributed to raise the final consumption by 95 Mtoe.
- Energy savings offset more than half of this activity effect by reducing consumption by 55 Mtoe.



Activity effect : mainly economic growth, plus demography and lifestyle changes (appliance ownership and larger dwellings).
Source: ODYSSEE; decomposition tool https://www.indicators.odyssee-mure.eu/decomposition.html

Energy savings first fuel in primary energy consumption

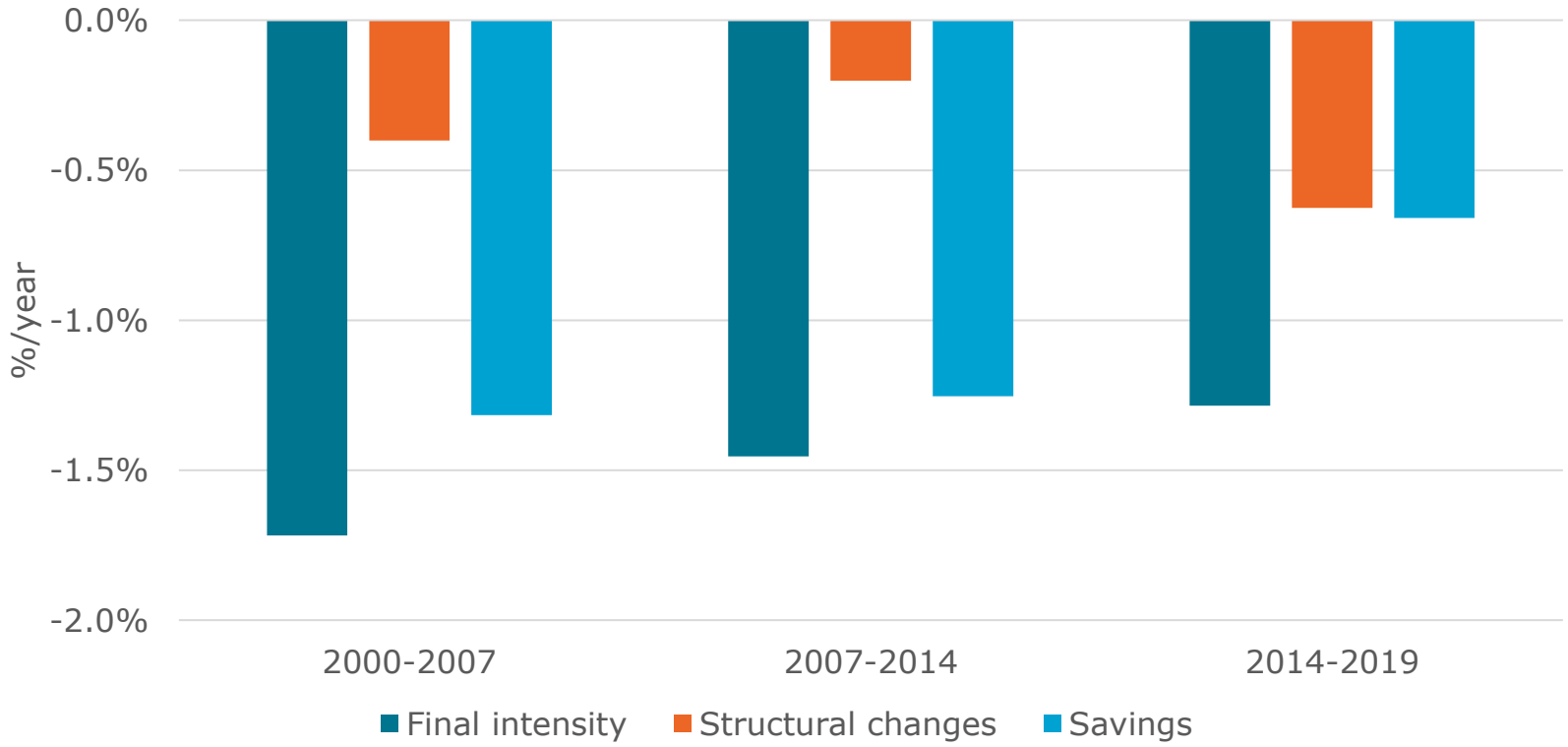
- Looking on a longer period, since 1990, energy savings have reduced primary consumption by around 580 Mtoe in 2019, i.e. the equivalent of 27% of that consumption.
- Energy savings is the first fuel in primary consumption in 2019 (4 points above oil with a share of 23%).



Source: *ODYSSEE*

Final energy intensity and energy efficiency trends

- Since 2014 energy efficiency only explains half of the final energy intensity reduction.
- Different types of structural changes (e.g. towards less energy intensive sectors (services) and industrial branches, saturation effects, higher value added products …) have contributed as much to the intensity reduction .
- Before 2014 most of the intensity decrease was due to energy efficiency improvements (around 80%)…



Source: *ODYSSEE*

Conclusions

Have we got off track?

EU Energy efficiency targets

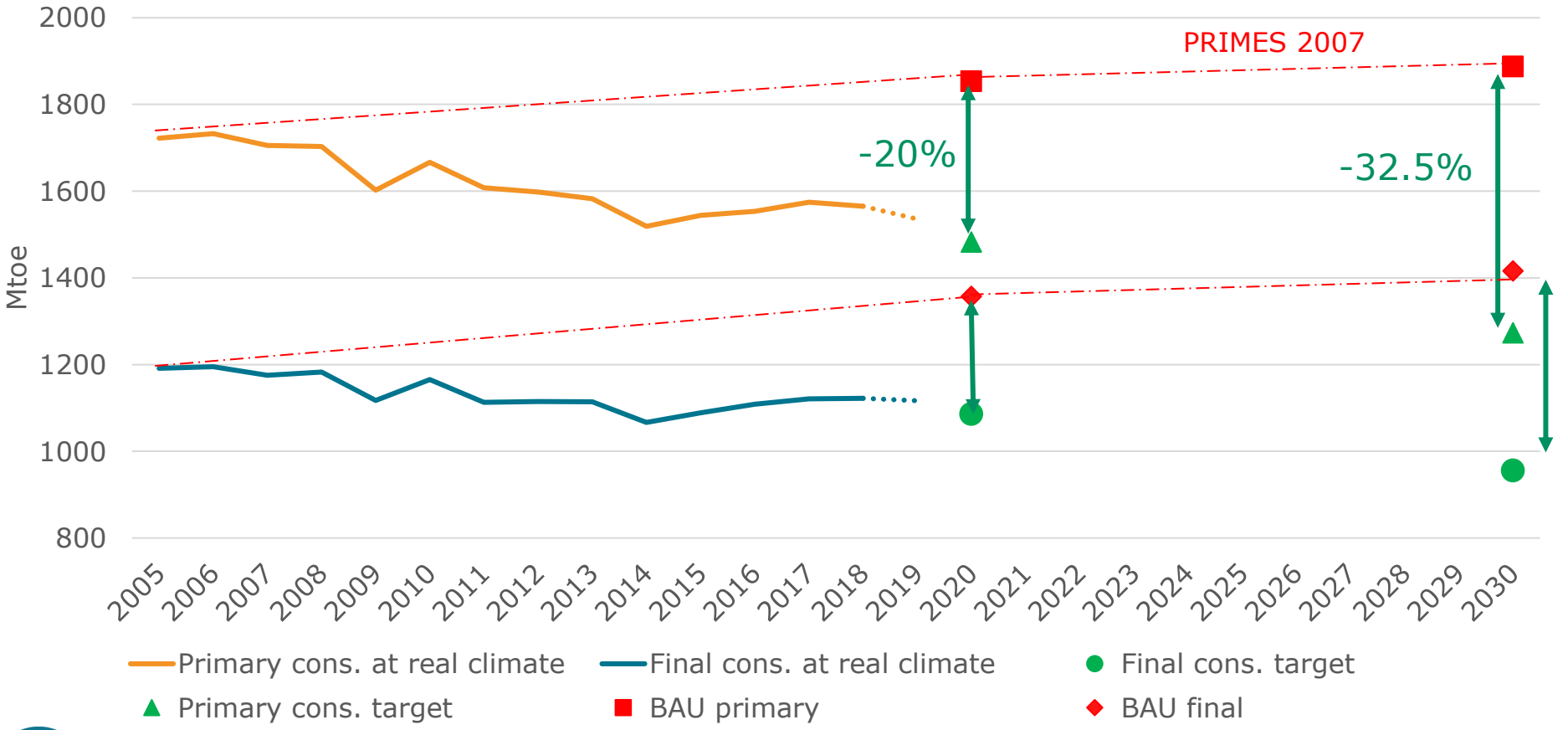
- Energy efficiency targets are always difficult to define, they can be expressed in terms of:
  i. Energy intensity reduction, but as explained, variation in intensity include other factors than energy efficiency;
  ii. Energy consumption reduction compared to a baseline;
  iii. Energy savings;
  iv. Energy consumption target level (i.e. absolute consumption cap)

- The EU has been using the 3 last types of targets, in a complementary way. If we refer to the most recent update of the EU energy efficiency law called EED (Energy Efficiency Directive), the EU has the following targets:
  - 32.5% energy saving target in 2030 (20% in 2020), for the EU as whole, compared to a Baseline projection*;
  - 1.5% additional energy savings until 2020 and 0.8% over 2021-2030 from energy savings obligation or policy measures (Article 7 of EED);
  - Primary and final energy consumption targets by country (Article 3).

** Referred to as PRIMES 2007 from the model name used*

Primary and final energy consumption targets

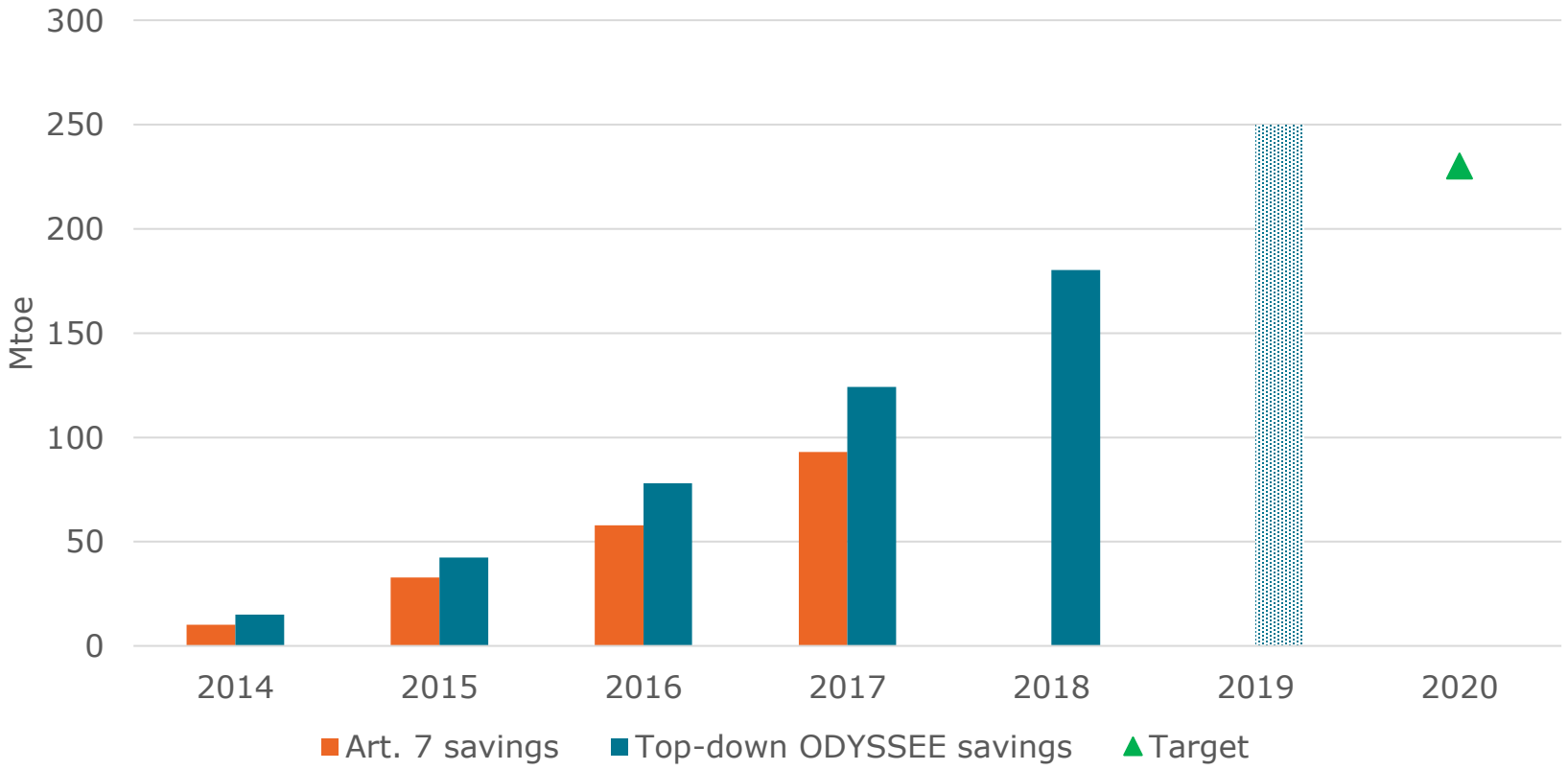
- In 2019, EU primary and final consumption were closed to the 2020 efficiency targets (around 4% and 3% above respectively).
- Warmer winters have helped achieving the targets (final consumption at normal climate 5% above target in 2019) .
- Past trends do not enable to reach the 2030 targets.



Source: ODYSSEE

Article 7 imposes a certain level of energy savings

- 1.5% of additional annual savings according to Article 7 of EED for final consumers over 2014-2020 (and 0.8%/year from 2021 to 2030).
- Energy savings from Article 7 as reported by MS reached 40% of 2020 target in 2017, our estimate based on indicators exceed the target but our savings are broader than Article 7 savings (as they include all types of savings: policy related and from autonomous progress).



Source: ODYSSEE
Savings target obtained by cumulating annual energy savings over 2014-2020

Conclusions

- Since 2014, the increasing share of renewables and more efficient thermal generation has offset 90% of the increase in final consumption.
- Energy efficiency improvement of final consumers has been much slower since 2007 in industry and since 2014 for households.
- The progression is the strongest for households (multiple regulations and incentives implemented at EU and national level).
- Have we got off track?
  - EU 2020 targets on primary consumption will be easily reached due to COVID crisis which will decrease consumption by 5 to 10% in 2020.
  - EU target to 2030 will not be reached with present trends and require additional measures, which is the purpose of Article 7.

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About Enerdata:

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We provide research, solutions, consulting and training to key energy players worldwide.

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